

1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050 2051 2052 2053 2054 2055 2056 2057 2058 2059 2060 2061 2062 2063 2064 2065 2066 2067 2068 2069 2070 2071 2072 2073 2074 2075 2076 2077 2078 2079 2080 2081 2082 2083 2084 2085 2086 2087 2088 2089 2090 2091 2092 2093 2094 2095 2096 2097 2098 2099 2100 2101 2102 2103 2104 2105 2106 2107 2108 2109 2110 2111 2112 2113 2114 2115 2116 2117 2118 2119 2120 2121 2122 2123 2124 2125 2126 2127 2128 2129 2130 2131 2132 2133 2134 2135 2136 2137 2138 2139 2140 2141 2142 2143 2144 2145 2146 2147 2148 2149 2150 2151 2152 2153 2154 2155 2156 2157 2158 2159 2160 2161 2162 2163 2164 2165 2166 2167 2168 2169 2170 2171 2172 2173 2174 2175 2176 2177 2178 2179 2180 2181 2182 2183 2184 2185 2186 2187 2188 2189 2190 2191 2192 2193 2194 2195 2196 2197 2198 2199 2200 2201 2202 2203 2204 2205 2206 2207 2208 2209 2210 2211 2212 2213 2214 2215 2216 2217 2218 2219 2220 2221 2222 2223 2224 2225 2226 2227 2228 2229 2230 2231 2232 2233 2234 2235 2236 2237 2238 2239 2240 2241 2242 2243 2244 2245 2246 2247 2248 2249 2250 2251 2252 2253 2254 2255 2256 2257 2258 2259 2260 2261 2262 2263 2264 2265 2266 2267 2268 2269 2270 2271 2272 2273 2274 2275 2276 2277 2278 2279 2280 2281 2282 2283 2284 2285 2286 2287 2288 2289 2290 2291 2292 2293 2294 2295 2296 2297 2298 2299 2300 2301 2302 2303 2304 2305 2306 2307 2308 2309 2310 2311 2312 2313 2314 2315 2316 2317 2318 2319 2320 2321 2322 2323 2324 2325 2326 2327 2328 2329 2330 2331 2332 2333 2334 2335 2336 2337 2338 2339 2340 2341 2342 2343 2344 2345 2346 2347 2348 2349 2350 2351 2352 2353 2354 2355 2356 2357 2358 2359 2360 2361 2362 2363 2364 2365 2366 2367 2368 2369 2370 2371 2372 2373 2374 2375 2376 2377 2378 2379 2380 2381 2382 2383 2384 2385 2386 2387 2388 2389 2390 2391 2392 2393 2394 2395 2396 2397 2398 2399 2400 2401 2402 2403 2404 2405 2406 2407 2408 2409 2410 2411 2412 2413 2414 2415 2416 2417 2418 2419 2420 2421 2422 2423 2424 2425 2426 2427 2428 2429 2430 2431 2432 2433 2434 2435 2436 2437 2438 2439 2440 2441 2442 2443 2444 2445 2446 2447 2448 2449 2450 2451 2452 2453 2454 2455 2456 2457 2458 2459 2460 2461 2462 2463 2464 2465 2466 2467 2468 2469 2470 2471 2472 2473 2474 2475 2476 2477 2478 2479 2480 2481 2482 2483 2484 2485 2486 2487 2488 2489 2490 2491 2492 2493 2494 2495 2496 2497 2498 2499 2500 2501 2502 2503 2504 2505 2506 2507 2508 2509 2510 2511 2512 2513 2514 2515 2516 2517 2518 2519 2520 2521 2522 2523 2524 2525 2526 2527 2528 2529 2530 2531 2532 2533 2534 2535 2536 2537 2538 2539 2540 2541 2542 2543 2544 2545 2546 2547 2548 2549 2550 2551 2552 2553 2554 2555 2556 2557 2558 2559 2560 2561 2562 2563 2564 2565 2566 2567 2568 2569 2570 2571 2572 2573 2574 2575 2576 2577 2578 2579 2580 2581 2582 2583 2584 2585 2586 2587 2588 2589 2590 2591 2592 2593 2594 2595 2596 2597 2598 2599 2600 2601 2602 2603 2604 2605 2606 2607 2608 2609 2610 2611 2612 2613 2614 2615 2616 2617 2618 2619 2620 2621 2622 2623 2624 2625 2626 2627 2628 2629 2630 2631 2632 2633 2634 2635 2636 2637 2638 2639 2640 2641 2642 2643 2644 2645 2646 2647 2648 2649 2650 2651 2652 2653 2654 2655 2656 2657 2658 2659 2660 2661 2662 2663 2664 2665 2666 2667 2668 2669 2670 2671 2672 2673 2674 2675 2676 2677 2678 2679 2680 2681 2682 2683 2684 2685 2686 2687 2688 2689 2690 2691 2692 2693 2694 2695 2696 2697 2698 2699 2700 2701 2702 2703 2704 2705 2706 2707 2708 2709 2710 2711 2712 2713 2714 2715 2716 2717 2718 2719 2720 2721 2722 2723 2724 2725 2726 2727 2728 2729 2730 2731 2732 2733 2734 2735 2736 2737 2738 2739 2740 2741 2742 2743 2744 2745 2746 2747 2748 2749 2750 2751 2752 2753 2754 2755 2756 2757 2758 2759 2760 2761 2762 2763 2764 2765 2766 2767 2768 2769 2770 2771 2772 2773 2774 2775 2776 2777 2778 2779 2780 2781 2782 2783 2784 2785 2786 2787 2788 2789 2790 2791 2792 2793 2794 2795 2796 2797 2798 2799 2800 2801 2802 2803 2804 2805 2806 2807 2

5

10

2. The head assembly as claimed in claim 1, wherein said layer covering the integrated circuit chip is formed by evaporation.

3. The head assembly as claimed in claim 2, wherein said layer is made of poly(p-xylylene).

4. The head assembly as claimed in claim 1, wherein said integrated circuit chip has a first surface provided with conductor bumps, and a second surface opposite to the first surface, wherein a peripheral portion of the second surface is chamfered.

35

5. The head assembly as claimed in claim 1, wherein said layer covers at least peripheral portions of the integrated circuit chip.

5

6. The head assembly as claimed in claim 1, wherein said layer is made of a low-viscosity resin selected from a group consisting of photo-curing resins including ultraviolet-curing resins, and thermosetting resins.

10

15

7. The head assembly as claimed in claim 1, which further comprises:

a head slider provided with a head,

20

a height of the integrated circuit chip, including the layer, from the mounting surface being lower than a height of the head slider from the mounting surface.

25

8. A disk unit for reading information from and writing information to a disk, comprising:

30

a head assembly having a mounting surface, a head mounted on the mounting surface, and an integrated circuit chip which is mounted on the mounting surface and processes information read from and/or written to the disk via the head,

35

said integrated circuit chip being covered by a layer.

Sup

9. The disk unit as claimed in claim 8, wherein said layer covers at least peripheral portions of the integrated circuit chip, and said layer is made of a low-viscosity resin selected from a group consisting of photo-curing resins including ultraviolet-curing resins, and thermosetting resins.

10

10. A semiconductor part comprising:
a main chip body; and
a covering layer formed by evaporation and covering the main chip body.

15

11. The semiconductor part as claimed in claim 10, wherein a portion of the main chip body is exposed via the covering layer.

25

12. The semiconductor part as claimed in claim 10, wherein said main chip body has an upper surface, a lower surface and peripheral side surfaces, and further comprising:

30

an integrated circuit formed on the lower surface of the main chip body;

conductor bumps formed on the lower surface of the main chip body;

35

an under-filling layer formed on the lower surface of the main chip body, so that tip ends of the conductor bumps are exposed via the under-filling layer,

said covering layer covering the upper surface and the peripheral side surfaces of the main chip body, and covering peripheral side surfaces of the under-filling layer.

5

13. The semiconductor part as claimed in claim 12, further comprising:

alignment marks provided on the lower surface of the main chip body on outer sides of the integrated circuit,

said under-filling layer having holes exposing the alignment marks.

14. A method of producing an integrated circuit chip which is mounted on and forms a part of a head assembly, comprising the steps of:

(a) forming a first layer on first and second surfaces of a wafer which has conductor bumps formed on one of the first and second surfaces located at opposite sides of the wafer;

(b) dicing the wafer having the first layer into a plurality of chips; and

(c) forming a second layer on peripheral side surfaces of each of the diced chips.

15. A method of producing an integrated circuit chip which is mounted on and forms a part of a head assembly, comprising the steps of:

(a) forming a first layer on a first surface of a wafer which has conductor bumps formed on a second surface of the wafer located at an opposite side from the first surface;

5 (b) dicing the wafer having the first layer into a plurality of chips in a state where the wafer is adhered on a film, without cutting the film;

(c) separating the film from only peripheral portions of each of the diced chips; and

10 (d) forming a second layer on each of the chips in a state where the peripheral portions of the diced chips are separated from the film.

15

16. A method of producing an integrated circuit chip which is mounted on and forms a part of a head assembly, comprising the steps of:

20 (a) adhering a film on a surface of a wafer which has conductor bumps formed thereon, so as to surround portions on the surface of the wafer, including the conductor bumps, which later become chips by a waved shape of the film;

25 (b) dicing the wafer having the film into a plurality of chips; and

(c) forming a layer on each of the diced chips.

30

17. A method of producing an integrated circuit chip which is mounted on and forms a part of a head assembly, said integrated circuit chip having
35 a main chip body and a layer covering the main chip body, said method comprising the steps of:

(a) supplying a predetermined amount of resin

which has a surface tension smaller than a wetting with respect to the main chip body from a nozzle onto an upper surface of the main chip body, said predetermined amount being larger than an amount of
5 the resin required to form the layer;

(b) moving the nozzle near the upper surface of the main chip body to a height corresponding to a thickness of the layer which is to be formed; and

(c) sucking resin by a suction force smaller
10 than the wetting with respect to the main chip body, so as to remove excess resin, to thereby form the layer which covers the main chip body.

15

18. A method of producing an integrated circuit chip which is mounted on and forms a part of a head assembly, said integrated circuit chip having
20 a main chip body, conductor bumps and a layer covering the main chip body, said method comprising the steps of:

(a) forming the layer on the main chip body and the conductor bumps by evaporation, in a state
25 before crushing pointed tip ends of the conductor bumps;

(b) pushing the conductor bumps against a surface to simultaneously crush the pointed tip ends of the conductor bumps and make the layer covering
30 the pointed tip ends to recede, to thereby expose surfaces at the crushed portions of the conductor bumps.

35

19. A method of producing an integrated

circuit chip which is mounted on and forms a part of a head assembly, said integrated circuit chip having a main chip body, conductor bumps and a layer covering the main chip body, said method comprising the steps of:

- (a) adhering a mold release agent on tip ends of the conductor bumps;
- (b) forming the layer on the entire main chip body including the conductor bumps by evaporation; and
- (c) removing portions of the layer on the tip ends of the conductor bumps having the mold release agent interposed therebetween, to thereby expose surfaces of the tip ends of the conductor bumps.

20. A bonding apparatus for bonding conductor bumps on a semiconductor chip onto corresponding pads on a substrate by ultrasonic vibration, comprising:

a stage having a receiving surface for receiving a first surface of the substrate opposite to a second surface of the substrate provided with the pads; and

a bonding unit having an end surface for holding a first surface of the semiconductor chip opposite to a second surface of the semiconductor chip provided with the conductor bumps, and a closing member having a closing surface,

said end surface adhering the first surface of the semiconductor chip by suction via a suction hole which opens at the end surface,

said closing member being movable to close the suction hole at the end surface, so that the closing surface and the end surface form a single flat

5

10

15

20

25

30

35

24. The bonding apparatus as claimed in claim 22, wherein said transport mechanism and said pressing mechanism are independent mechanisms.

25. The bonding apparatus as claimed in claim 22, wherein said transport mechanism and said pressing mechanism are formed by a single mechanism.

5

26. The bonding apparatus as claimed in claim 22, further comprising:

10 an ultrasonic radiator provided on the stage and subjecting the substrate to ultrasonic vibration when bonding the bumps on the corresponding pads.

15

27. The bonding apparatus as claimed in claim 20, wherein the end surface has an area greater than an area of the first surface of the semiconductor chip.

20

28. A bonding method for bonding conductor bumps on a semiconductor chip onto corresponding pads on a substrate by ultrasonic vibration, comprising the steps of:

25

(a) placing the substrate on a stage having a receiving surface for receiving a first surface of the substrate opposite to a second surface of the substrate provided with the pads;

30

(b) holding and transporting the semiconductor chip to a bonding position above the stage by a bonding unit, said bonding unit having an end surface for holding a first surface of the semiconductor chip opposite to a second surface of

35

the semiconductor chip provided with the conductor bumps by suction via a suction hole which opens at the end surface, and having a movable closing member having a closing surface which forms a single flat surface together with the end surface when the closing member is moved to close the suction hole at the end surface;

(c) pressing the semiconductor chip against the substrate by the end surface in a state where the suction hole at the end surface is closed by the closing member; and

(d) bonding the conductor pads to the corresponding pads by ultrasonic vibration.

29. The bonding method as claimed in claim 28, wherein said step (d) subjects one of the semiconductor chip and the substrate to ultrasonic vibration when bonding the bumps on the corresponding pads.

Handwritten signature/initials.